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(54) **Friction welding**

(57) In a method of securing a plastics fastener stud 10 to a compressed fibre pad, an end portion 14 of the stud 10 is spun at high speed in contact with the pad while pressing the stud against the pad so that it penetrates into the fibrous mass. The end portion of the stud fuses and becomes bonded to the fibres to a substantial depth. The spinning is effected by inserting the stud in a rotary chuck of a high speed electric drill.

The method is useful in attaching studs to trim pads for lining car doors.

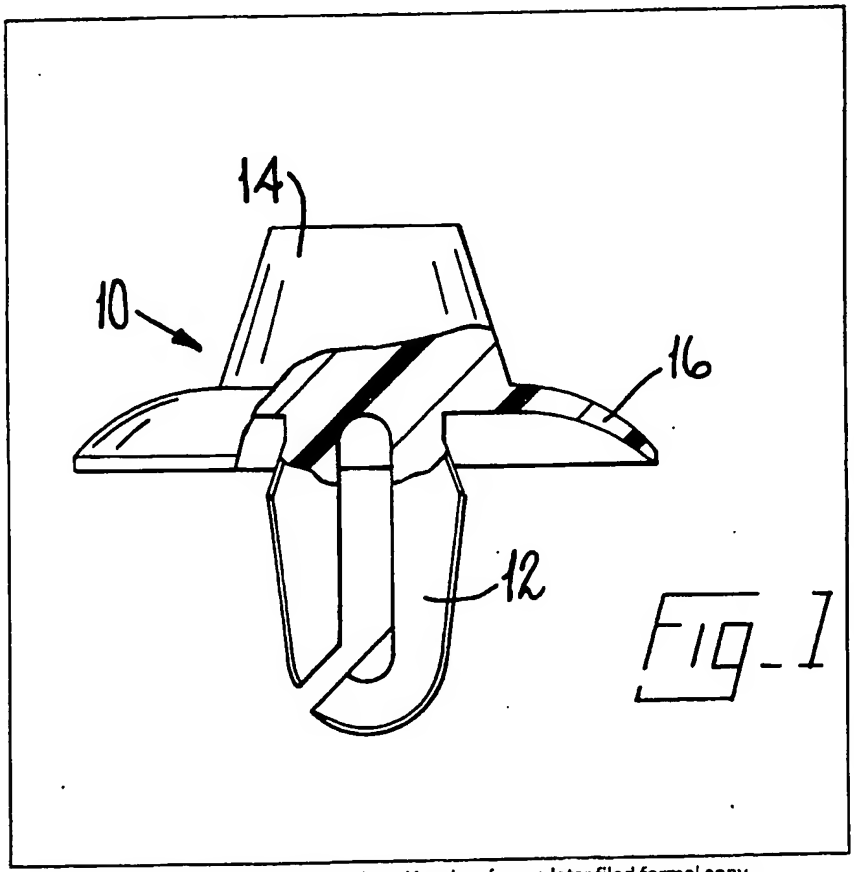

Fig_1

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The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.

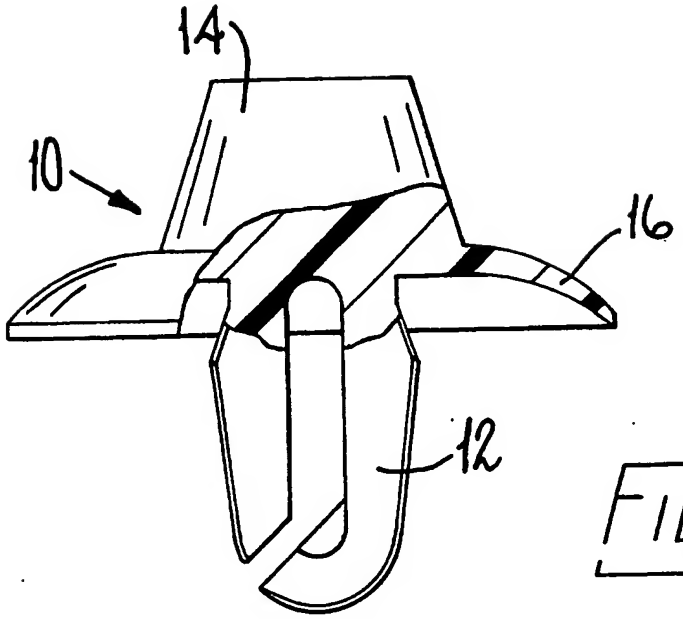

Fig_1

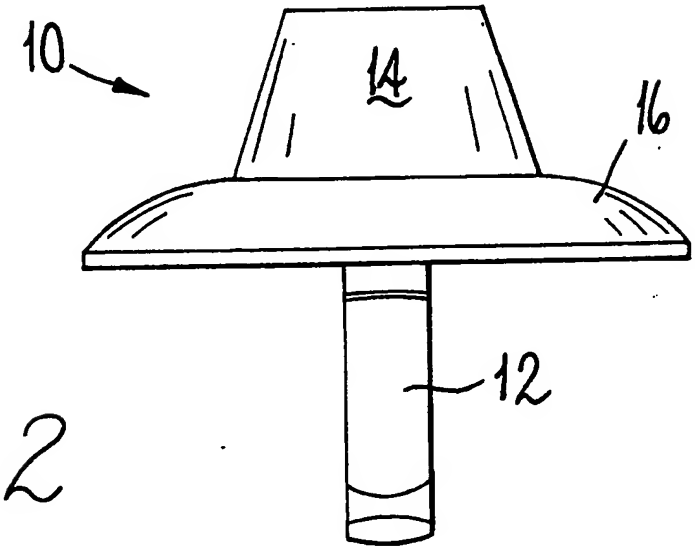

Fig_2

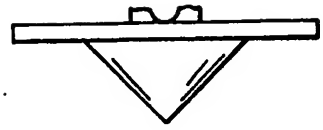

Fig_3a

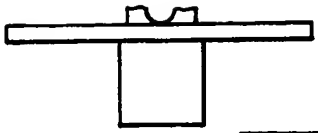

Fig_3b

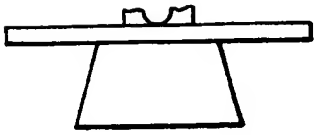

Fig_3c

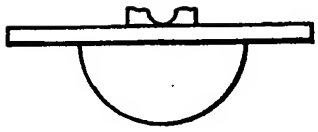

Fig_3d

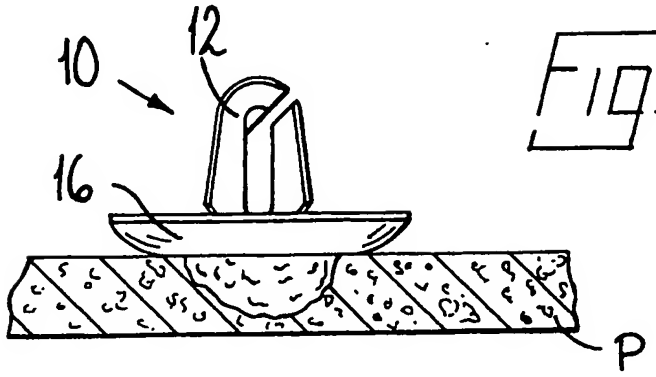

Fig_4

SPECIFICATION

Fasteners and method of fastening

This invention is concerned in one of its chief aspects with a method of securing a plastics fastener to a pad of compressed fibrous material.

It is a known practice to line the doors of cars with fibreboard covered by a decorative sheet bonded to the board around its margins. In one common method using such a pad, keyhole slots are punched in the fibreboard base of the pad in dispositions corresponding to holes in the panel of the car door and thereafter one side of the board is covered by the decorative sheet. Double-headed studs having shanks for insertion into the panel holes are then assembled in the keyhole slots of the board and the pad presented to the panel; the shanks of the studs are shaped to retain the studs in the holes when they have been pushed into them. Such a method is applicable for the attachment of pads where a loose enough covering permits the double-headed studs to be assembled on the fibreboard base. A problem arises, however, if the pad is not of such construction, or is not made in such a way, that the fibreboard base can have the keyhole slots punched in it and a separate decorative sheet provided to serve as a layer over the heads of the assembled studs.

An attempt to secure heads of studs to the side of a compressed fibre pad opposite to the decorative side by adhesive, for example, does not solve the aforementioned problem because the kind of fibreboard normally used for trim pads readily delaminates if an attempt is made to pull off a stud so bonded to it. It is essential that trim pads are attached to the panels of car doors in a way which permits removal of the pads to gain access to the door lock and window winding mechanisms.

The foregoing problem is met in accordance with the present invention in that a plastics fastener is secured to a pad of compressed fibrous material by a method which includes the step of pressing a leading end portion of the fastener against the pad while rotating the fastener atthigh speed (i.e. in excess of 1,500 r.p.m.) whereby said leading end portion penetrates the pad and becomes fused with the fibres to a substantial depth.

Preferably, the leading end portion of the fastener tapers towards its tip; it may be frusto-conical and may have a pip at the centre of its end face. When the invention is carried out for the purpose of attaching a trim pad to a car door panel, each fastener may have an attaching shank extending in the opposite direction from said leading end portion, the shank being adapted for insertion into and retention in a hole in the panel. Fasteners are secured first to the pad at localities disposed in the same pattern as the holes in the panel and the fasteners penetrate deeply into the pad. But they do not pass right through, and they become firmly secured in the depth of the pad without marring what will be the exposed surface of the pad. It is therefore unnecessary for any keyhole slots or other holes to be punched through any fibreboard base of which the pad may be made. Any such base may have an integral decorative finish on its exposed surface.

Any suitable thermoplastic polymeric material may be used for the fastener, one with a high melting point, for example, nylon or polycarbonate, being preferred.

Preferably, in a method according to the invention, the compressed fibrous material in which the leading end portion of the fastener becomes embedded is a hot-pressed mixture of fibre and powdered thermoplastic or thermosetting polymeric bonding agent. The presence of a hard bonding agent, such as a cured phenol-formaldhyde resin, at least at the surface of the pad to which the fastener is to be attached, assists the generation of heat and melting of the material of the fastener.

In order to ensure the generation of sufficient heat in as short a time as possible, the periphery of the leading end portion of the fastener should be as long as practical. Preferably, the fastener has a flange which determines, or enables the operator to determine, when the penetrating of the pad by the stud should be arrested.

A fastener in accordance with the invention may have any suitable shape of shank, for example one arranged for retention in a hole in a panel.. A shank of a shape suitable for engagement in the chuck of a conventional electric drill, or which may readily be held by such a chuck with the assistance of an adaptor, is preferred.

A fastener in accordance with the invention and a method of securing it to a pad, both selected to illustrate the invention by way of example and not of limitation, will now be described with reference to the accompanying drawings in which:-

Figures 1 and *2* are views in side elevation from directions at 90° to one another about the axis of the illustrative fastener;

Figures 3a, b, c and *d* show alternative shapes of leading end portions of fasteners in accordance with the invention; and

Figure 4 is a diagrammatic representation of the bond, in diametrical section, obtained between the illustrative fastener and a compressed fibre pad in carrying out the illustrative method.

The illustrative fastener is a one-piece stud 10 moulded from nylon 66 and having an attaching shank 12 (for insertion into a hole in the panel) extending in the opposite direction to a frustoconical leading end portion 14 which tapers towards a leading tip of the stud. A dished flexible skirt 16, its concave side facing the shank, surrounds the shank at the larger end of the frustoconical leading end portion. The shank 12 is of a known shape for retention in a hole in a metal panel.

In carrying out the illustrative method, the shank of the illustrative fastener is inserted in a rotary chuck of a suitable tool, for example a high speed electric drill, e.g. one in which the chuck rotates at 2,400 r.p.m., and with the leading end portion 14 of the fastener at the locality on a pad P where it is desired the stud is secured, the chuck is rotated and the drill urged towards the pad. The end face of the leading end portion of the stud may have a central

pip (not shown) to avoid displacement of the stud over the surface of the pad. The leading end portion of the stud, pressed against the pad, penetrates the pad material and becomes fused and firmly bonded to the surrounding fibres to a substantial depth. The drill is stopped when the skirt 16 reaches the surface of the pad.

Where the pad is a bonded mixture of fibres for use for trim pads, for example one in which random laid fibres (e.g. cotton) have been mixed with a partially cured phenol-formaldehyde novalak resin and pressed between hot platens with hexamine until the resin has fully cured, the stud is found to be securely anchored to the pad without marring what will be the exposed surface of the pad, which may have an integral decorative finish before application of the stud. The depth of penetration of the leading end portion 14 of the stud ensures that the pad does not readily de-laminate when an attempt is made to pull the stud from it.

The desired number of studs having been secured to the pad at the desired localities, the pad may be presented to the panel of a car door and the shanks of the studs pressed into their receiving holes. The pad may be detached from the panel as so required without any risk of the studs becoming dislodged from the pad.

It is not essential that the leading end portion of a stud in accordance with the invention is frustoconical. Alternative shapes are shown in Figure 3, viz., (a) conical with an apical angle of about 90°, (b) cylindrical (c) frustoconical but with the large end leading and (d) hemipherical.

CLAIMS

1. A method of securing a plastics fastener to a pad of compressed fibrous material comprising the step of pressing a leading end portion of the fastener against the pad while rotating the fastener at high speed (i.e. in excess of 1,500 r.p.m.) whereby said leading end portion penetrates the pad and becomes fused with the fibres to a substantial depth.

2. A method according to claim 1 wherein the leading end portion of the fastener tapers towards its tip.

3. A method according to claim 2 wherein the leading end portion is frustoconical.

4. A method according to claim 3 in which the fastener has a pip at the centre of the end face of its frustoconical portion.

5. A method according to any one of the preceding claims in which the fastener is made of nylon.

6. A method according to any one of the preceding claims in which the pad consists of a hot-pressed mixture of fibre and thermosetting polymeric bonding agent.

7. A method of attaching a compressed fibre trim pad to a panel (e.g. of a vehicle) by means of studs having shanks inserted into holes in the panel, each stud being secured to the pad by carrying out a method according to any one of the preceding claims, and the disposition of the studs corresponding to that of the holes in the panel into which the shanks are inserted.

8. A stud for use in carrying out a method according to claim 1 comprising an attaching portion extending in one direction for insertion into a panel hole to retain the stud therein, and, extending in the opposite direction, a leading end portion shaped for penetration into a fibrous pad upon high speed rotation of the stud.

9. A stud according to claim 8 the leading end portion of which is frustoconical, tapering towards its leading end.

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